The Mysore Coffee Experiment Station—Bulletin No. 17

DEPARTMENT OF AGRICULTURE

MYSORE STATE

ANNUAL REPORT OF THE COFFEE SCIENTIFIC OFFICER, 1937-38

BY

W. WILSON MAYNE, B.Sc.,

Coffee Scientific Officer to the United Planters' Association of Southern India.

IMPERIAL MYCOLOGICAL INSTITUTE
19 SEP 1938

BANGALORE:
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FOREWORD.

In the present report of the Coffee Scientific Officer which is, as usual, published as a bulletin of the Mysore Coffee Experiment Station, more attention, than in previous years, is devoted to the baffling disease, Black Bean, which has been alarmingly on the increase in some of the estates. An attempt has also been made to get an insight into the apparently inevitable crop losses during development and a relationship between a good set of fruit and the rapid growth of flush after blossom showers is suggested.

The Government of His Highness the Maharaja of Mysore are enforcing the removal of borer-infested coffee bushes—a measure of immense help to planters in mitigating the spread of the disease. With close co-operation between the Entomologist and the Coffee Scientific Officer in carrying out experiments to prevent borer attack, it is hoped that our attempts will meet with success.

T. G. RAMA IYER,
Director of Agriculture.

1st July 1938.

ANNUAL REPORT OF THE COFFEE SCIENTIFIC OFFICER 1937-38.

I have the honour to present the administration report of the Coffee Scientific Officer for the year ending 31st March 1938, dealing with work in progress in connection with coffee problems. As usual, the report contains an account of the investigations in progress and general notes on coffee problems which have arisen during the year. Work has been centred at the Mysore Government Coffee Experiment Station as in previous years.

The Coffee Scientific Officer was on home leave from the beginning of the year until the end of October. During this period the Assistant Scientific Officer took charge of his work and office.

Touring.—The Assistant Scientific Officer visited Coorg twice during the absence of the Scientific Officer in connection with work in progress there. On his return from leave, the Scientific Officer paid a short visit to Mercara to address a meeting of Coorg planters. In February, a visit was paid to the Nelliampathy hills. An address was given at the annual meeting of the Mysore Planters' Association in February 1938.

In connection with proposals to initiate an investigation into the quality of coffee, the Scientific Officer attended the November meeting of the Imperial Council of Agricultural Research and served on the *ad hoc* committee to consider the proposals. He was also invited to serve on the Cinchona sub-committee held at the same time.

Investigations.—Investigation work suffered some unavoidable interruptions owing to the absence of the Coffee Scientific Officer on leave. The Assistant Coffee Scientific Officer carried out routine work under several heads which will be detailed below.

Leaf Disease.—There is relatively little of interest to report under this head for the current year. The study of the behaviour of various families derived from known parents towards strains of *Hemileia* has been continued.

Some difficulties were experienced with stocks of the different strains and a survey of the position at the Station was commenced with regard to the frequency of occurrence of the two strains which have been so far studied. A large number of tests were made of collections of spores made in various parts of the estate and their behaviour to indicator plants determined. It was found that the Strain I (the strain to which Kent plants are normally resistant) was much commoner than Strain II to which Kents are susceptible. It may be said that the coffee in the estate is mainly Coorg.

Further attention has been given to the study of Strain III which has shown signs of some increase in certain families of coffee which proved resistant to the other two strains. Much more difficulty has attended the isolation and culture of this Strain and further study is required.

At present the testing work provides no new results but is necessary to establish firmly the tentative conclusions already reported.

Work on Spray Materials and Methods.

Spray mixtures.—Work on this subject has been considerably curtailed for the reasons stated last year. It may be of interest to note that work in East Africa on the use of certain adhesives bears out the conclusions reached by the work done in previous years and reported in earlier annual reports.

Observations of the usual type were carried out in connection with an experiment to test two copper oxide sprays laid out at the Experiment Station. The results were as follows:—

TABLE I.	Leaf Index.	Percentage Infection.
Bordeaux ...	6·42	40·0 per cent.
Material A. ...	5·98	25·3 „
„ B. ...	7·35	38·4 „

Owing to an abnormal value in one of the Bordeaux plots which gave a much higher leaf index and a much lower percentage infection that the other two, comparisons are difficult and no definite conclusions can be drawn. The two other materials gave more concordant results in the replications. The materials, more especially B, show some promise and it is hoped that they may be given a more extended trial.

Time and Strength of Spray.—Observations bearing on the time of spray application and the strength of mixture were carried out as in previous years. The data showed no special features. It is of interest to note that the Control unsprayed plots showed a disease intensity in accordance with expectations on the theory that the length of the dry season and the showeriness of the hot weather are primary factors in governing the severity of the disease attack in September—October.

Timing of the Hot Weather Spray.—The observations reported last year bearing on the time of application of the hot weather spray in relation to the blossom showers were repeated in the current year. Though there are some differences, the trend of the results is the same as last year. The results of both years are given in Tables II and III.

Table II.—Percentage of Leaf Survival and Percentage Infection of Surviving Leaves in Plots sprayed at different dates in the Hot Weather. (Cropping Shoots).

Sprayed, Days after shower.	1936		1937	
Days.	Survival. per cent	Infection. per cent	Survival. per cent	Infection. per cent
24	61·9	48·9	56·9	67·0
38	56·7	56·1	63·0	37·4
52	52·6	58·1	60·4	44·4
66	41·1	41·1	38·5	90·2

Table III.—Corresponding Data for non-cropping shoots (*i.e.*, New Growth.)

24	66·3	66·0	78·0	66·8
38	72·3	57·7	76·2	63·2
52	59·0	58·1	72·2	55·0
66	62·8	53·5	63·2	79·2

The success of the treatment is indicated by a high figure for leaf survival and a low figure for percentage infection. An examination of the figures given in Table II shows that in 1936, the first plot sprayed earliest has given the best results while in 1937 the second plot gives the best figures. The most striking feature in each year, is the marked falling off of the last spray results.

The data for the non-cropping shoots show the same general trend, though the differences are less marked. In 1936 the second spray date has given the best figure for leaf survival, the percentage infections differing relatively

little. In 1937, the first three sprays have given generally similar results which are all better than the fourth.

These results fully bear out the conclusion that the success of the spray does not depend primarily on spraying when the largest amount of leaf is available on the trees.

It must be made clear that these data refer to the control of Leaf Disease (*Hemileia vastatrix*) and not to the control of Black rot. In the case of the latter disease, it is obvious from the behaviour of the disease, that it is important to cover the maximum amount of flush and this can best be attained by spraying as close to the onset of the south-west monsoon as possible.

These results afford strong support to the view expressed in Bulletin No. 15, that in the control of Leaf Disease, the total proportion of the flush which can be protected is not the sole criterion for successful spraying. The period during which the leaf is exposed to infection prior to the spray application is also of great importance. The comparative failure of the spray application made about two months after the blossom shower in both years is of considerable interest and importance in connection with spray programmes against *Hemileia vastatrix*.

Studies on the Coffee Fruit and Seed.

Crop losses during Development.—Observations on this problem were discontinued during the year. Six years' data are available and it was considered desirable to work these up before commencing any further observational work on the subject. The following remarks cover several interesting points which have arisen in the course of these studies and are published here pending a complete account of the whole series of observations.

The work involved the detailed observation of the growth, development and fruit set of 100 typical cropping branches taken at random through an area of about one acre at the Experiment Station which is sprayed in May and September and receives a general fertilizer after the S.-W. monsoon. Records were kept from 1931 to 1936 for the period from the blossom showers until the harvest in each year.

The first striking feature was the close correspondence between the number of flower buds present at blossom time and the number of leaves present on the same branches. The data are given in Table IV.

Table IV.—Flower buds and Leaves on 100 cropping branches at Blossom time.

Year.		Buds.	Leaves.	Buds/leaves.
1931	...	9,330	832	11·2
1932	...	5,380	405	13·3
1933	...	6,946	540	12·5
1934	...	5,310	434	12·2
1935	...	3,054	347	8·8
1936	...	6,130	600	10·2

It can be seen that on the whole there is a close correspondence between the number of leaves present at the time of the observation and the number of flower buds present on the branches. It should be pointed out that the branches used were of the same type (9-11 joints in length) in each year. This observation serves to indicate the great importance of the leaf area in relation to bud production under local conditions, and suggests that adequate supplies of carbohydrates are one of the main controlling factors in determining crop size.

An attempt to study the possibility of a relation between the amount of bud and amount of leaf on each branch in any one season was made by calculating correlation coefficients for each set of 100 observations.

Table V.—Correlation coefficients between Flower buds and leaves present on Crop Branches.

			Correlation Coefficient.
1931	...	...	+·0046
1932	...	...	+·0169
1933	...	...	+·1518
1934	...	...	+·1830
1935	...	...	...
1936	...	...	+·0790

All the correlations were positive but very small and quite insignificant. The data suggest that the general crop level in a year probably depends primarily on the effective leaf area, whereas the crop production of individual branches in a given year depends on other factors. It must be understood that the amount of leaf present at blossom time is to be regarded as an indicator of the leaf position on such branches at an earlier period when photosynthesis is active.

The second striking feature which emerges from the study of the data is the wide variations in setting of fruit by different branches in the same year. The general data

for fruit set have been given in earlier reports and need not be repeated here. A study of the set of fruit on individual branches suggested that branches might be divided into two series—those which set well and those which set badly. An inspection of the records showed that there was no suggestion in the area in question that this was a constitutional character. A branch from a given tree might set well in one year and a similar branch from the same tree in another year might set badly. In the first year, more than one branch was sometimes recorded on one tree and in such cases the branches from the same tree varied in fruit setting considerably.

An attempt was therefore made to compare series of branches with similar amounts of bud but which showed wide differences in fruit setting, in order to see if any differences could be seen in their growth and development. The data given in Table VI are those for 1931.

Table VI.—Development Data for Branches showing a Good Set of Fruit and for those showing Poor Set. (24 pairs of branches).

	Good Set.	Poor Set.
Original Bud ...	2,106	2,106
Fruit maturing ...	1,099	535
Original Leaves ...	214	158
Total Hot Weather growth (No. of leaves) ...	224	230
Percentage of growth made in first 3 weeks after blossom ...	58	46

It can be seen that there are two points in which the two sets of branches appear to differ, beside the difference in fruit set. The good set branches show a higher initial number of leaves and a notably higher percentage of their hot weather growth in the first few weeks after blossom. It may also be noted that there is but little difference in the total growth made in the hot weather.

The data have been worked out similarly for four other years and show similar figures. The most striking feature is the difference in the proportion of the hot weather growth expanded in the first three weeks after the resumption of active growth. The actual differences were 12 per cent in 1931, 12 per cent in 1932, 10 per cent in 1934, 10 per cent in 1935, and 7 per cent in 1936.

The figures suggest that there is a relation between a good set of fruit and the rapid growth of flush immediately after the blossom showers. This is further

supported by the fact that in 1934, when the flush was seriously delayed in all branches the set was much lower than in any other year. The difference in the initial number of leaves seems less important as it was only noted in three out of the five years for which the data have been worked out.

These data suggest several obvious lines of work directed to study the possibility of giving practical effect to the results.

The importance of setting on crop production needs no emphasis. It can be seen from Table VI, that equal numbers of cropping shoots carrying similar amounts of flower bud showed a difference of 100 per cent in the number of fruit produced.

In two years a study was made of the branch thickness at blossom time, measurements being made in the centre of the basal internode. In both years the good set branches were thicker than the poor set branches as can be seen from the figures given in Table VII.

Table VII.—The Thickness of Branches which set well compared with those which set poorly.

	Good Set.	Poor Set.
1932	4·54 mm.	4·14 mm.
1934	3·75 mm.	3·58 mm.

A statistical examination of these data, using Fisher's "t" test shows that the difference is significant in 1932 but not significant in 1934. It is a matter of common experience that stout branches as a rule set their crop better than thin whippy ones.

With regard to the distribution of crop losses, the general course has been given in earlier reports. In summary, it may be said that the loss of developing fruit occurs generally in three stages, the first loss occurs in the fortnight or so immediately after blossom, the second becomes visible when noticeable swelling starts and consists largely of small fruit initials which never develop and gradually disappear in later months, and the third occurs usually in the early part of the S.-W. monsoon and consists of partly swollen fruit. There is practically no further loss of fruit after the early part of the S.-W. monsoon except such as may be due to mechanical injury or to parasitic diseases such as Black Rot or Die Back.

A comparison of the distribution of loss in the pairs of good and poor set branches shows that the greater loss

in the case of the poor set branches may be distributed over all three stages more or less evenly but is more often concentrated in the first loss. The latter was the case in 1931, 1932 and 1936 and the former in 1935. In 1934, the greater loss in the poor set branches was concentrated in the third loss period. At the same time, the loss at each stage in every year was usually higher from the poor set branches.

Fruit development and defects —The continuation of studies on fruit development was interrupted during the first part of the year. During the crop season, the widespread reports of serious loss by Black Bean and similar defects led to renewed attention to this disease. The work done reinforced the conclusion reached in previous years that the cause of these troubles must be sought much earlier in the crop season than the harvest time. A study of a great mass of material during the current season has made possible a tentative grouping of a number of defects all of which appear to be fundamentally related. The common feature presented by all the defects lies in abnormalities in the silver skin. The following list represents the defects identified :—

1. Black Jelloo.
2. Spotted bean.
3. Black bean.
4. " Burnt " bean.
5. Green bean.
6. Dry and Coated bean (?).

Of course the actual visible peculiarities of these defects differ appreciably but in all cases, a microscopic examination reveals abnormalities in the silver skin layer. Of these defects, the first and sometimes the second and third, occur as floaters, the second to fifth are all visible in the wet parchment and can be identified on the drying table on the first day after washing. The last has not so far been detected except in dried beans sent up by the curers.

The main complaints received from estates usually refer to class 1 and 3. The former always leads to bad vat out-turns and the affected beans are a total loss. The latter is a very obvious defect and may also lead to poor vat out-turns, though some reach the coast and are garbled out. The remaining defects, although they cause a marked reduction in value, do not result in a total loss as affected beans are marketable as triage.

The studies made in the present year were mainly concerned with the third, fourth and fifth classes, though

a certain amount of attention has been given to the others. The work involved an anatomical study of defective beans and microchemical tests on the tissues.

For convenience, classes 1 and 2 may be considered together. Anatomical studies show quite clearly that Black Jelloo and Spotted Bean are the same defect differing only in degree. The former is characterized by its colour which varies from light brown to black and its lightness. It is usually more or less wrinkled and soft and on drying becomes a mere fragment of a papery texture. The latter defect is characterized by the presence of a clearly defined spot or area which is usually of the same appearance as the surface of the Black Jelloo, dark, soft and wrinkled. A complete series can easily be collected between the complete Black Jelloo and a Spotted Bean bearing an affected area of not more than a millimetre or so.

Microscopically, sections show that the bean tissues have been more or less completely broken down. In the region of breakdown, the silver skin shows an abnormal cellular development and in the Black Jelloo, practically the whole of the bean consists of this abnormally developed silver skin.

Classes 3 and 4 may also be taken together as these also appear to be the same defect differing in degree. The term Black Bean is here restricted to beans which are black in colour and which when wet are smooth and almost normal in shape. They are usually also heavier than the Black Jelloo and frequently reach the drying tables. The "Burnt" Beans show a greater or less degree of brown staining on the bean surface, the discoloration being diffuse and shading off into normal tissue, unlike spotted beans where the spots are sharply defined.

The microscopic structure of these beans shows no actual breakdown of the structure of the bean tissues, but a greater or less proportion of the bean cells show a collapse of their cell contents and microchemical tests suggest that the cell walls have been modified in their composition. Where the surface is black or brown the inner layer of the silver skin shows the persistance of a cellular structure, which is absent in normal beans. The discoloration is caused by a brown layer between this cellular layer of the silver skin and the main bean tissue. It may be remarked that the colour in the Black Jelloo and Spotted Bean is due to a similar layer in the same relative position. This discoloured layer is structureless.

It is probable that classes 5 and 6 may also be grouped together. In these, the only obvious feature apart from the colour in class five is the presence of an inner layer of cells in the silver skin, which is absent in normal beans. This layer consists of small parenchymatous cells four or five cells deep and closely resembles the cell layer in Black and " Burnt " Beans. In normal beans the inner layer of the silver skin is represented only by a collapsed and structureless layer of material. The colour in the green beans occurs in the cells of the inner silver skin layer and although it has not been accurately identified, looks like chlorophyll. It occurs in plastids in the cells. No detailed study has been made of class 6 beyond the examination of soaked beans taken from commercial samples of dried beans, in which it was possible to see the cellular structure of the inner silver skin layer. On drying the green beans invariably give much shrunken beans which can be described as extreme cases of dry and withered beans.

In all these cases it can be seen that the inner silver skin layer bulks largely. In the first two classes, this layer not only has persisted but shows that it has developed large numbers of cells by proliferation and caused a more or less complete breakdown of the bean tissue. In the second two classes, there is no indication of development by proliferation and the breakdown of the cellular structure of the bean is not obvious, though internal changes are indicated. In the third two classes, there is no obvious indication of change of the bean tissues in any way but the cell layer of the inner silver skin persists.

Attention is focussed on the inner silver skin layer. The origin and importance of this tissue has been mentioned in earlier reports. It is undoubtedly through this tissue that food materials and water pass into the bean during the later stages of development. Normally this appears to break down during the maturing of the bean. The anatomical data suggest that in the defective beans this tissue does not break down in the normal way but retains the structure of an active tissue, which in the case of Black Jelloo and Spotted Bean may actually begin to develop on its own account, probably at the expense of the materials already elaborated in the developing bean.

All the evidence that has been collected suggests that these defects are due to a disturbance of the moisture or nutritive supply of the bean during a comparatively late

stage of development. This stage appears to lie sometime in the monsoon period and probably varies with the stage of development the bean has reached at the onset of the monsoon. Certain abnormalities of cereal seeds which are associated with excessive moisture are suggestive in relation to the problem as they show somewhat similar abnormal activity in seed coat tissues.

It was found that in the case of both "Burnt" Beans and "Green" Beans, the loss of weight on drying was constantly greater than in the case of normal beans. Some data collected on this point are given in Table VIII.

Table VIII.—Loss of Weight of "Burnt" and "Green" Beans on Drying.

Expt. 1.	Loss in weight. Per cent
Normal Beans	49
"Green" Beans	54
"Burnt" Beans	54
Expt. 2.	
Normal Beans	49
"Green" Beans	60
Expt. 3.	
Normal Beans	49
"Burnt" Beans	53

In all three tests it can be seen that the loss of weight on drying in the case of normal beans was constant at 49 per cent whereas both "Burnt" and "Green" beans showed losses varying between 53 per cent and 60 per cent. It may be said that there was no indication that these defective beans were lighter than the normal beans in the wet condition, except in the case of the "Green" Beans in the second test which were significantly lighter in wet weight than the normal.

These results indicate either a higher water content of the defective beans or a greater power of absorbing water during washing. Unfortunately these tests were only carried out after washing the fermented beans and no tests were made from freshly pulped material. This will be carried out next season, if material is available.

It is clear that the defects originate when the main bean tissue is forming or has already formed. The actual time when this occurs is variable. The only available data refer to the years 1934, 1935 and 1936. In the first year, the change occupied approximately the month of August. In 1935, the first signs of the change were noted about 22nd July but not seen in material examined on

11th. In 1936, the first signs of change were noted as early as the middle of June. It may be noted in this connection that the hot weathers of 1934 and 1935 were dry, whereas that of 1936 was notably wetter. In 1934, defective beans, mainly Black Jelloo occurred to the extent of about seven per cent of the fruit harvested in the Fruit Loss Observations. In the other two years, the amounts were small—about 0·5 per cent in 1935 and 1·3 per cent in 1936. Further observations of this description will be necessary in an effort to get at the factors involved.

Records of a number of years in which Black Bean occurred have been studied but they seem to have few obvious points in common, and no definite conclusions can be drawn. In view of the fact that in bad Black Bean years, reports come in from almost all the districts subject to a heavy S.-W. monsoon rainfall, while in other years, it is merely an odd estate from which reports come, it seems likely that some climatic factor is involved.

Further lines of approach to this problem include the continuation of studies into the course of development of the bean, with special reference to the monsoon period and the study of the water relations of the coffee plant during the same period.

Studies on Coffee Preparation.—Owing to the work on defective beans no further work was taken up on fermentation along the lines noted last year. However, reports have been received that a treatment suggested last year appeared to have some effect in reducing the risks of foxiness in places where it is liable to occur. This treatment consists in washing the partly fermented coffee the morning after pulping and then re-heaping for the completion of the normal period. This report is noted as it may prove useful to other estates where foxiness is liable to occur.

Pale Beans in the Raw.—At the request of a planter, a comparison of the weights of samples of Pales and of normal beans was made during the crop season. The samples were received from Mangalore and consisted of two lots, one of Pales and one of normal beans from the same consignment. It was found that the Pales were about five per cent lighter than the normal beans and this difference was significant on the basis of Fisher's 't' test. The difference is small and it seems rather doubtful whether it would be possible to separate such beans by

their weight differences in the wet condition. Work in another connection suggests that the differences in wet weight are likely to be even smaller than in the dry.

Work on Nematode Worms and Supply Establishment.—Investigations on this subject have been interrupted during the year. Further confirmation of the ability of *Anguillulina pratensis* and *Anguillulina multicincta* to invade and destroy healthy coffee roots has been obtained. The latter species has also been found in the roots of Dadap at the Coffee Experiment Station. Cross inoculation with worms of *A multicincta* from Dadap roots showed invasion of coffee roots, though in the area in question no damage to coffee has been noted.

Damage to Dadap by *Heterodera marioni*, the gall worm was noted at the Experiment Station on an area where Dadaps were poor. This worm has also been found in Coorg and may be frequently the cause of the poor growth of this shade tree in many areas, as is the case in tea.

During furlough, the Scientific Officer took the opportunity of discussing the problem of eelworm in coffee with Dr. Goodey of the Institute of Agricultural Parasitology at St. Albans. The fruits of that discussion were to indicate that the possibilities of any direct control measures seemed very uncertain.

Through the agency of the Imperial Bureau of Agricultural Parasitology, identifications of material collected in Coorg were obtained. The results confirmed the earlier conclusion that the main agent of the injury to young coffee is the species *Anguillulina pratensis. A. multicincta* as a second species attacking coffee was also confirmed.

Control of Borer.—A study of the results of an experiment laid out last year on an estate of the Consolidated Coffee Estates Ltd., gave the following data:—

TABLE IX,

Material.	*Treatment.*	*Date.*	*Borer Removed.*
Mortegg 5 per cent	... Rubbed	... 17–10–36	3·0 per cent
Do	... do	... 28–10–36	0·4 ,,
Do	... do	... 7–11–36	1·1 ,,
Do	... do	... 17–11–36	1·1 ,,
Do	... do	... 26–11–36	1·2 ,,
Do	... Unrubbed	... 8–11–36	2·0 ,,
Control	... Rubbed	... 17–11–36	2·3 ,,
Control	... Unrubbed	... ...	2·5 ,,

Approximately half acre was subjected to each treatment each half acre being made up of two plots of about quarter acre each.

The differences between the two plots under the same treatment were often considerable and but little can be stated with certainty. There is however, confirmation of the value of Mortegg in all the plots treated in November (including the plot treated at the end of October), with the exception of the unrubbed plots. No great reliance can be placed on this last result as the whole of the removals for this treatment came from one plot at the border of the experiment.

It is obviously very difficult to lay out suitable experiments to test the questions which were set. The comparatively low level of removals even with a severe attack of borer would necessitate a large number of rather large plots for the collection of data of statistical value: moreover, the problem of side or edge effects in the case of a pest like borer is a very serious one.

Control of Green Bug.—Some further trials with mineral oil emulsions similar to those reported last year were carried out by the Assistant Coffee Scientific Officer. At the same time tests were made of the effect of adding both the mineral oil emulsions and Honge Oil to Bordeaux mixture. The addition of mineral oil emulsion to Bordeaux resulted in some reduction in the efficiency of the former, thus confirming tests of a previous year. There was some bug mortality when Honge oil was mixed with Bordeaux at the rate of one per cent and one and half per cent (80 and 120 fluid ozs. per 50 gallons respectively) but hardly sufficient to afford any really adequate control.

Cardamom Diseases.—The Assistant devoted a considerable part of his time at Balehonnur during the Scientific Officer's absence to an investigation of the wart disease (Kaggi Kai) of cardamoms. A full account of this work has been prepared and will shortly be published. The cause of the injuries has been experimentally proved to be due to a species of thrips, whose life history and habits have been worked out. Certain possible control measures have suggested themselves and are in the process of being tried out.

General Notes 1937-38.—At the Experiment Station, blossom showers were ample and timely at the end of March 1937. Other areas were less fortunate and

experienced early blossoms in February. April was a normal month in most areas but May was very dry; at the Station, the May rainfall was markedly below normal. The monsoon was distinguished by a mild June and an exceptionally dry August and following this the N.-E. monsoon was also small.

The most striking features of the year from the point of view of the coffee crop was the extreme earliness of ripening and the extent to which the crop was affected by Black Bean and similar defects. The Leaf Disease situation was not notably severe which is probably to be attributed to the dry conditions in May and early June. Crops were small almost everywhere and the earliness resulted in an unprecedented early conclusion of the harvest.

The early promise for the year 1938-39 was good but in a number of areas blossom showers were poor and budding up was not as good as was at first expected. There was some rain in late December which did not help matters, in some areas actually producing a small blossom. It seemed that the early harvest was associated with early spike development and some areas showed signs of burning off in the very hot March of 1938.

The poor rains of the late monsoon from August onwards was responsible for indications of water shortage and the prospect of difficulties with hot weather spraying programmes.

It is difficult not to associate the high incidence of Black Bean with the abnormal weather conditions of August, but there are no reasons to assume that this was necessarily the case. A high incidence on Black Bean in earlier years was not associated with such weather conditions. It does not seem likely that a direct relationship between climate and this disease will be readily traceable, without a knowledge of the times at which the beans reach critical stages in their development.

Fungus Diseases.—No new fungus diseases were reported during the year nor were there any exceptional outbreaks of the common diseases.

Insect Pests.—Borer continued to be the most serious insect pest on coffee estates. The removals in the year under review were very high and it seems more than likely that the very dry May resulted in the showing up of many attacked plants which might otherwise have been overlooked. There seems no question that the position of

this pest has become much more serious in the last few years. It seems that there are three primary factors responsible for this.

1. There has been a succession of years of poor N.-E. rainfall which has been recognized as an important factor in affecting borer attack.

2. As a result of the very depressed state of the industry, work on many small holdings has been drastically reduced and other areas have been virtually abandoned, with the result that borer removals have become even less efficient than they were.

3. There are indications that removals on well managed estates may have become rather less efficient owing to spraying. It is not suggested that spraying has been responsible for a *direct* increase of borer, although statements to this effect have been made. The influences have been indirect, in that it seems possible that a healthy leafy tree may fail to show symptoms of attack when the soil moisture supply is abundant, although they can be discerned when moisture is short. The labour requirement for hot weather spraying has tended to leave little labour available in the hot weather for borer work. Borer spotting and removal has tended to be more and more concentrated in the monsoon months, when some affected trees will have made a recovery from the symptoms which would be obvious in the dry weather. It is probable that the proportion of trees with concealed symptoms will be greater with spraying than without if they are only marked in the wet monsoon months.

There can be no question that the efficient removal of attacked trees is of primary importance in dealing with borer and this must lie at the base of any attempts to bring this serious pest under control.

Other Work.—While on leave the Scientific Officer visited the Imperial Institute of Mycology, the Imperial Bureau of Agricultural Parasitology and spent a week at the Fruit Experiment Station at East Malling, Kent. An opportunity presented itself of discussing coffee problems with Mr. J. MacDonald, Senior Plant Pathologist to the Kenya Dept. of Agriculture.

A meeting arranged by Mr. Oliver, Director of Indian Coffee Propaganda was attended at which a valuable opportunity presented itself to discuss problems of defects in Indian coffee with members of the London Coffee Trade.

Acknowledgments.—It is once more a pleasure to record my appreciation of the cordial co-operation and assistance I have received from the Director and Staff of the Department of Agriculture throughout the year. In addition, I desire to express my thanks to the officers of the various institutions I visited during my leave and to the other gentlemen with whom I had opportunities to discuss coffee problems, for their kindness and help.

Finally, as in the past, I am glad to thank the many planters who have assisted me in various aspects of the work on coffee problems.

During the year Mr. Subramanyam has been of the greatest assistance, both in the carrying on of routine work during my absence and in his special work in connection with Nematodes, Borer control and Cardamom disease.

W. WILSON MAYNE,
Coffee Scientific Officer.

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